

Agenda

1. Why do we have Structural/Mechanical Engineers (in Research)?
2. Design, Build and Test a model bridge.

Build a Bridge

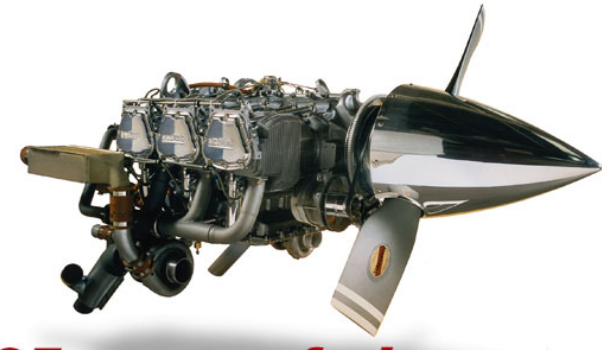
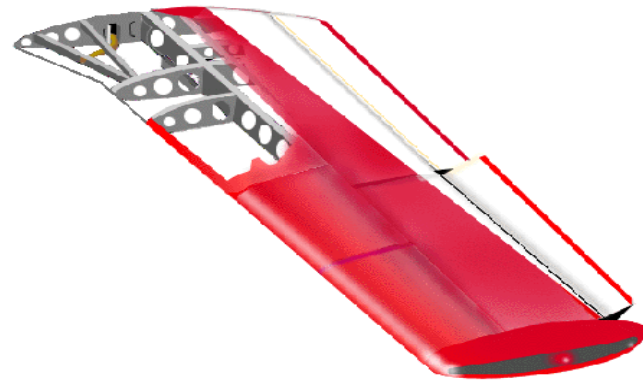
Post 630 Starting Point

To build an Airplane

Wings/Control Surfaces!



Structures



Engines

Classical Truss Bridge



More Common Use of Structures



Aerospace Bridge

Totally Tubular

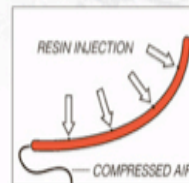
A technology that uses fiber-reinforced plastic arches filled with concrete may be a solution for replacing some of the nation's deteriorating bridges.



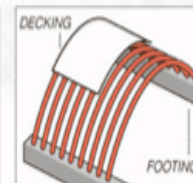
A SERIES OF TUBES

The arches are tubes of carbon-fiber and glass-fiber fabric that are covered with decking and filled with concrete at the site. The decking is then covered with a thin layer of concrete, followed by soil, gravel and asphalt.

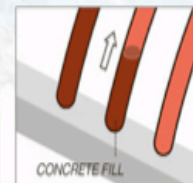
BUILDING SEQUENCE



The tubes are inflated, bent to shape and infused with resin to make them rigid.



The hollow, light tubes can be placed without heavy-duty cranes or other equipment.



Once in position, they are filled with concrete that expands slightly as it cures.



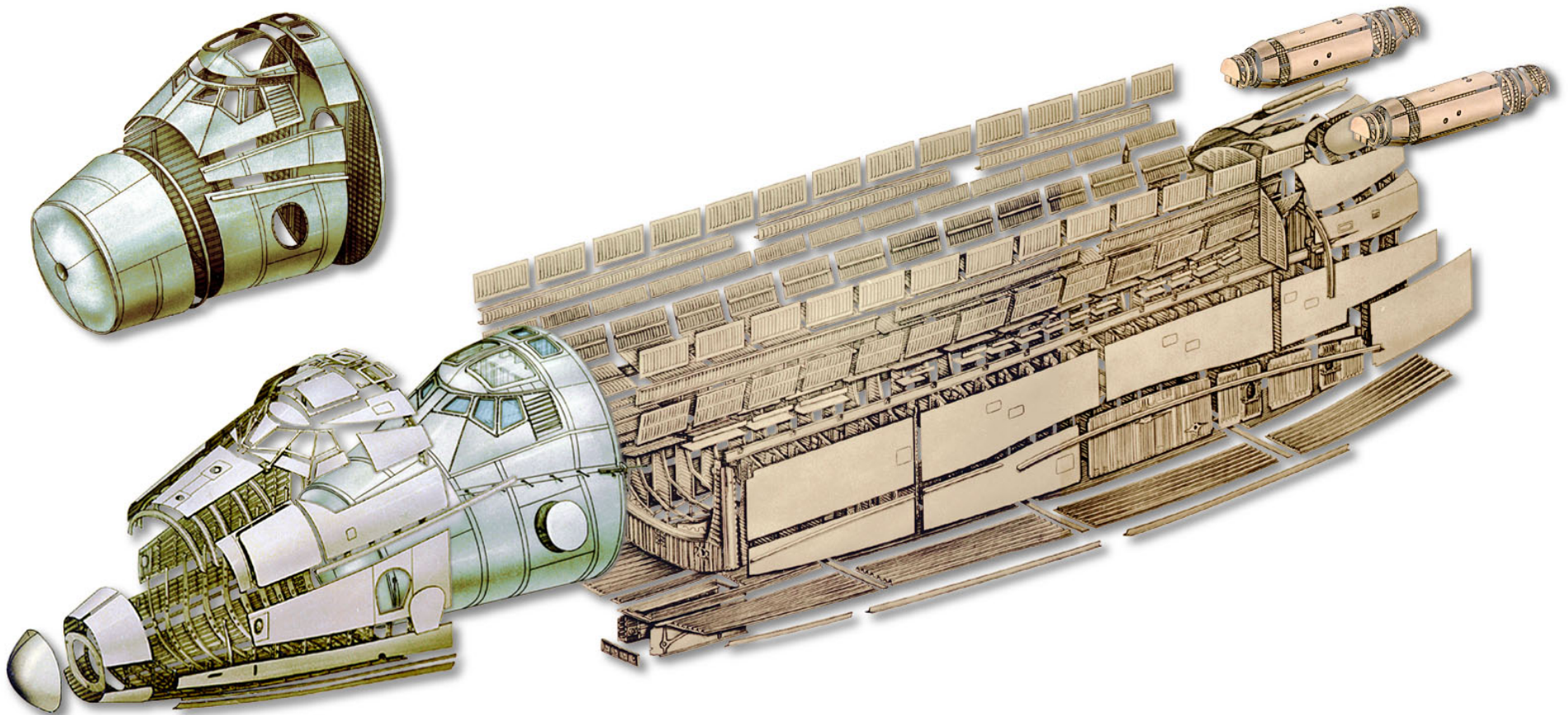
Fill is placed on top and compacted, followed by gravel and the road surface.

Source: University of Maine

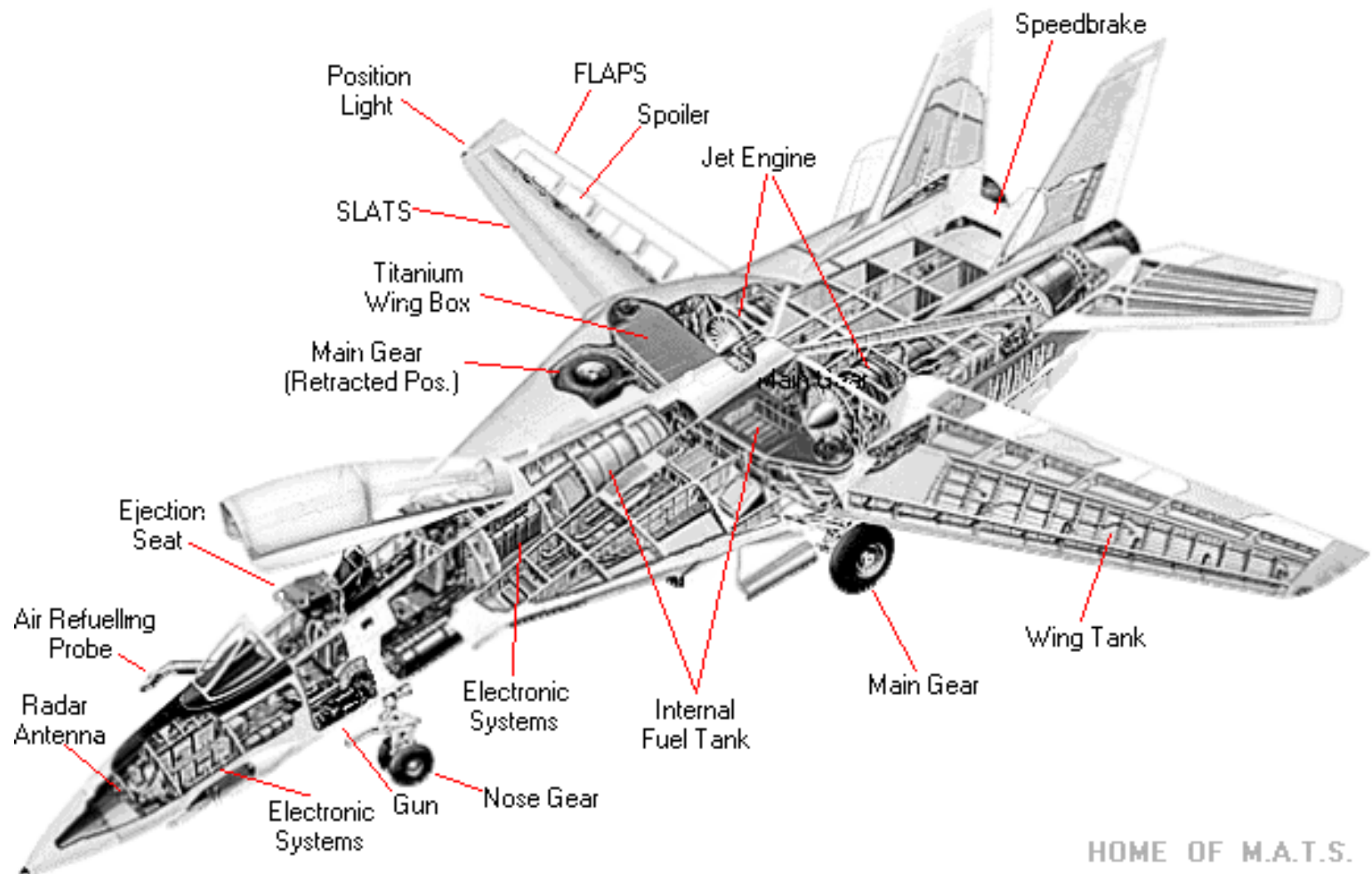
MIKA GRÖNQVIST/THE NEW YORK TIMES

TWITTER

Buran Structure

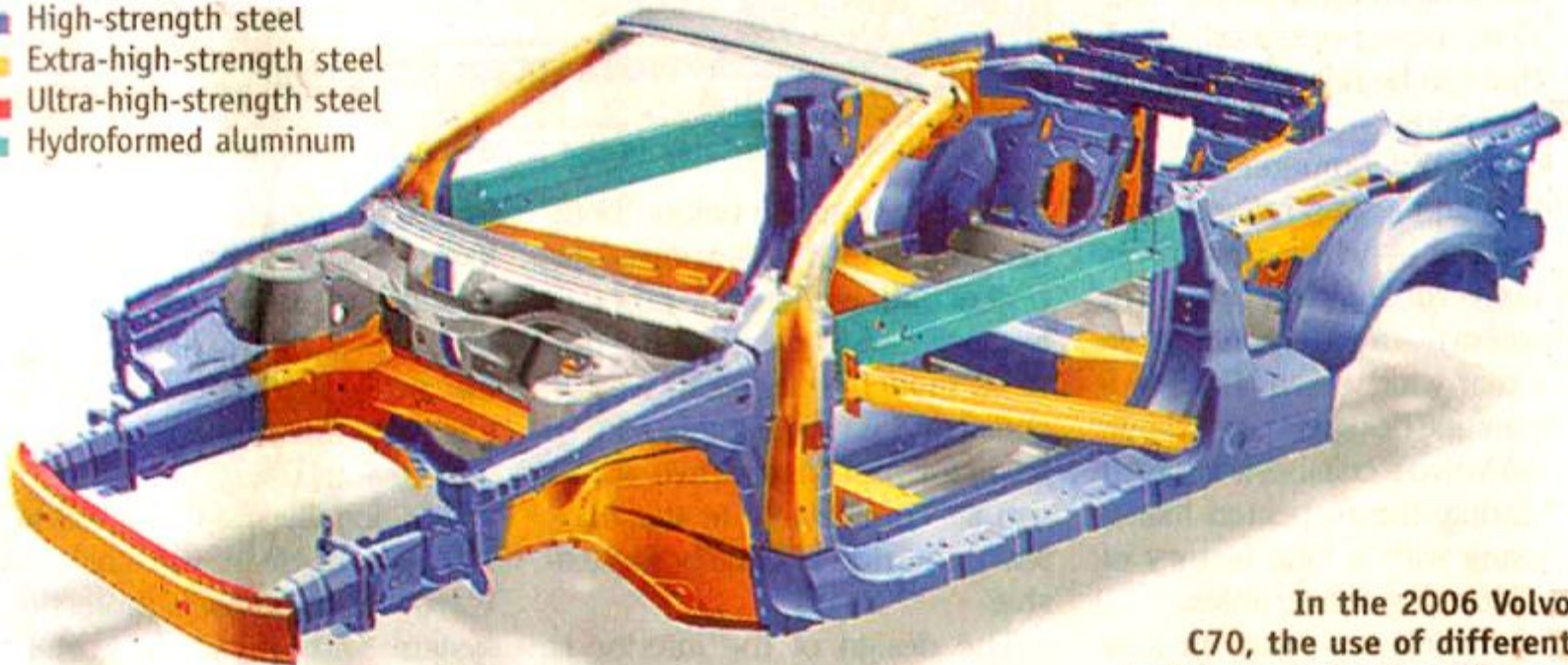


Wing structure



Volvo Structure

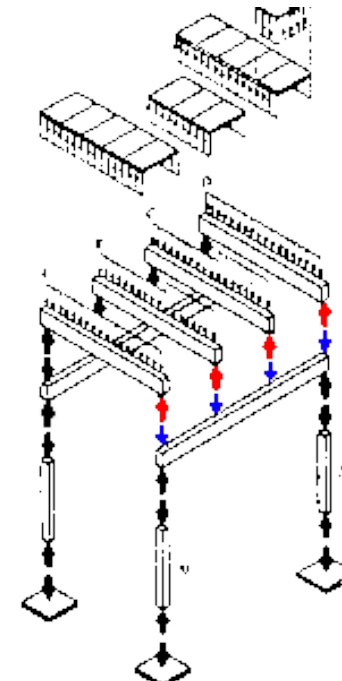
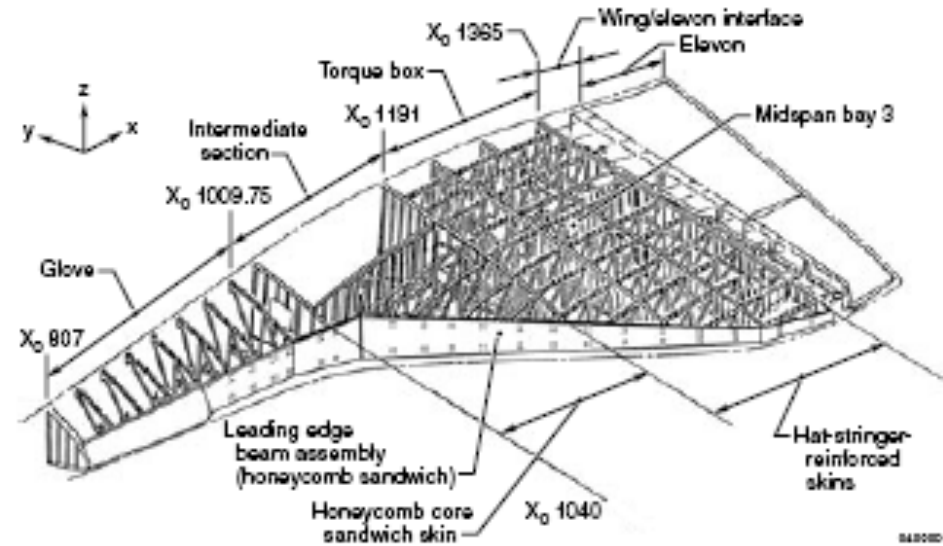
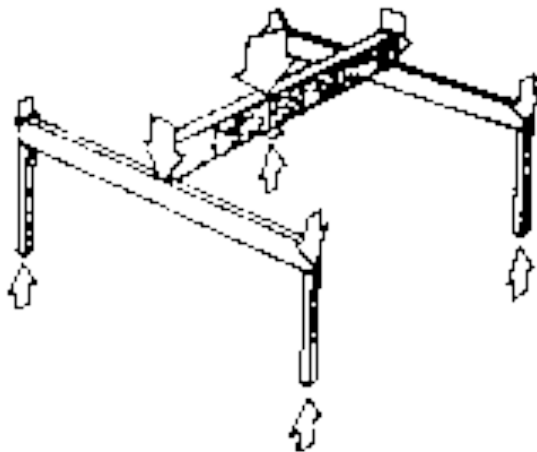
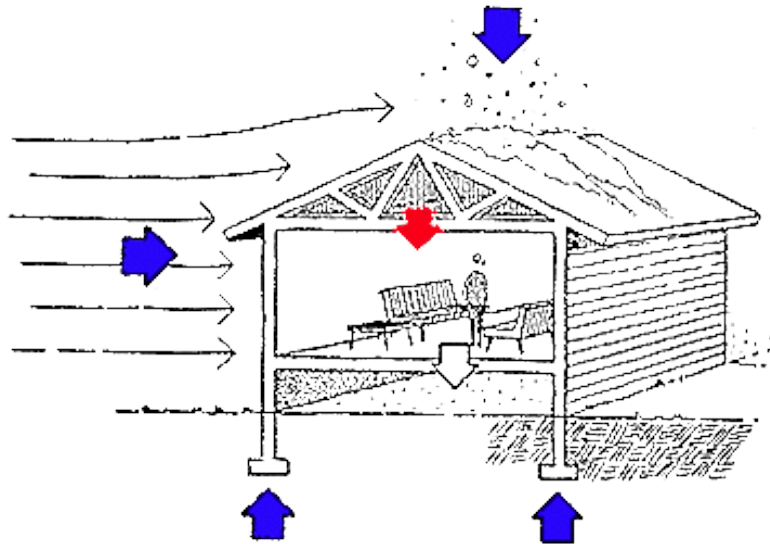
- Mild steel
- High-strength steel
- Extra-high-strength steel
- Ultra-high-strength steel
- Hydroformed aluminum

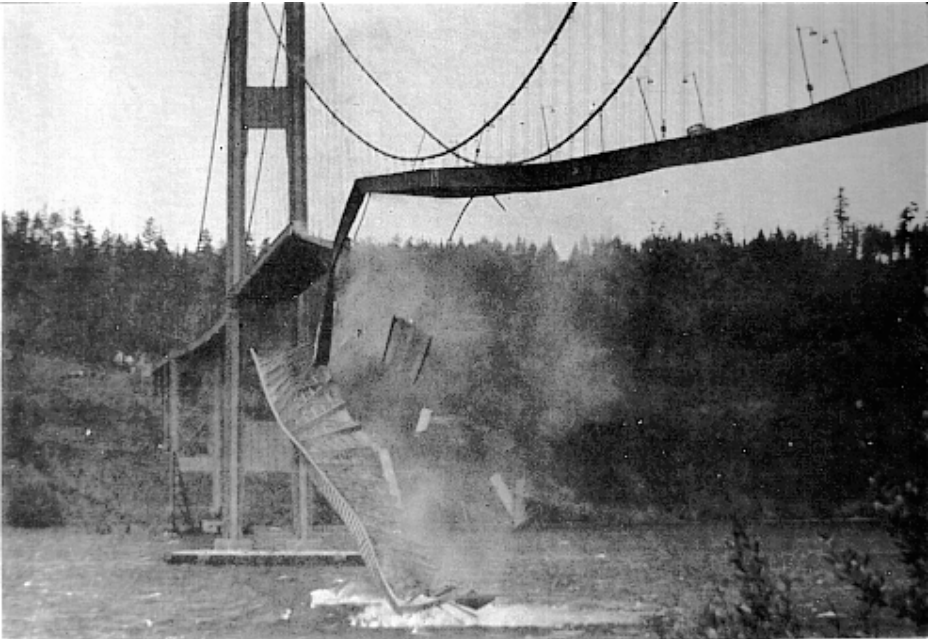


In the 2006 Volvo C70, the use of different metal strengths for different components protects the passenger compartment in case of collision.

Structural Models

❖ Model vs. Reality





Using your 'noodles' contest:)



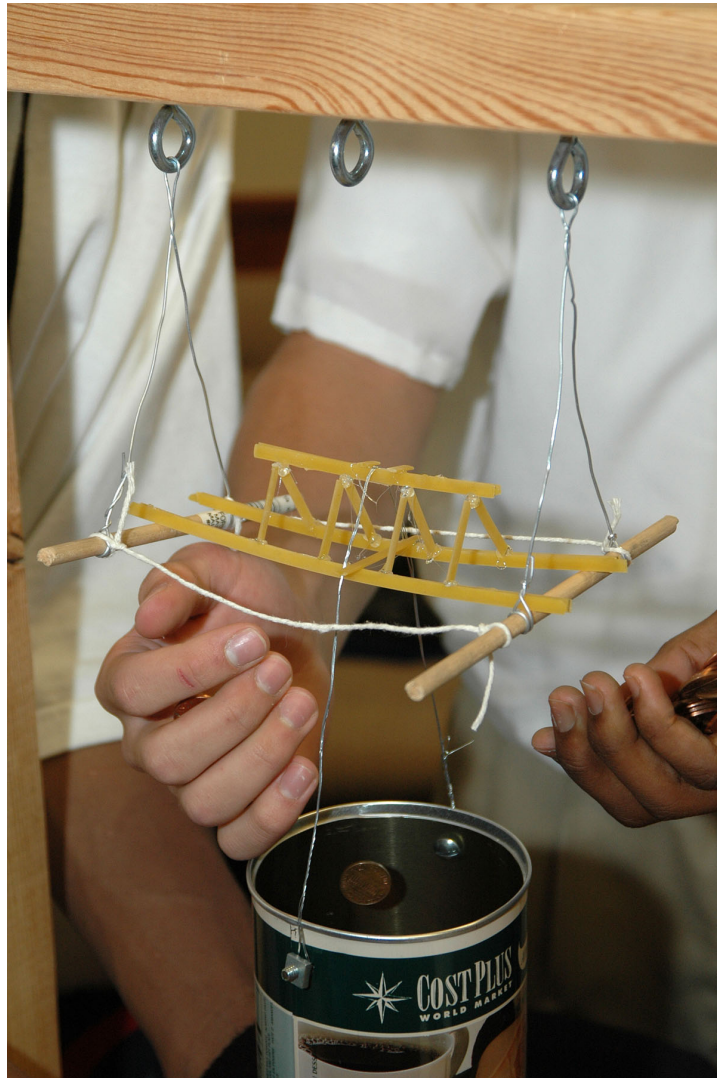
Discussion



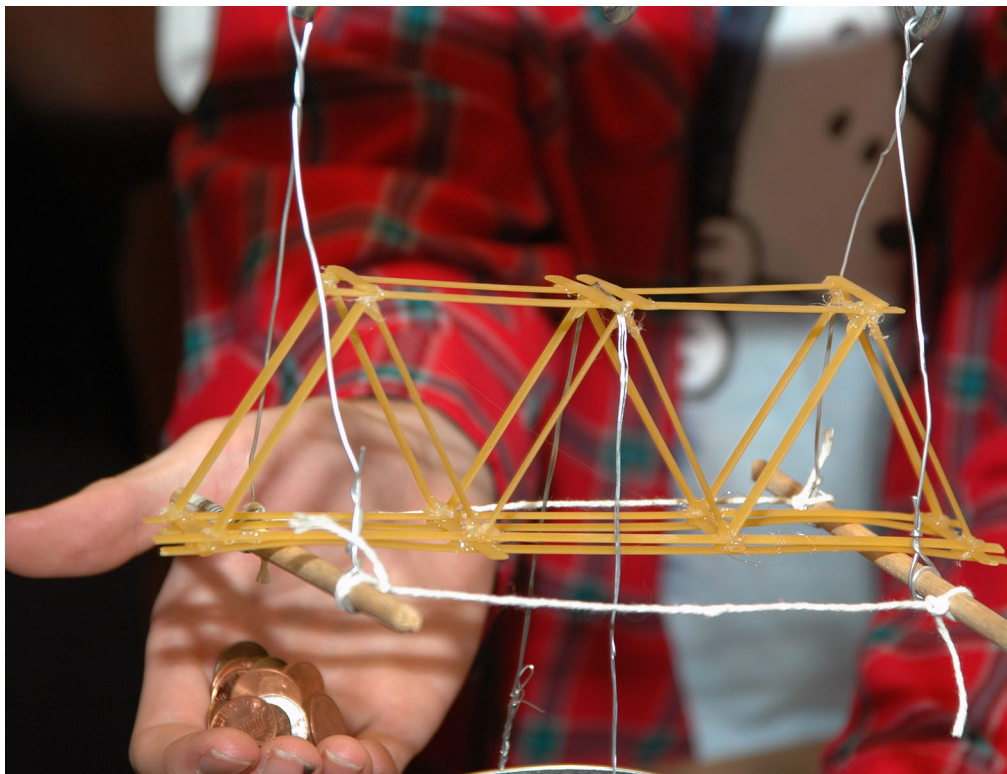
Discussion



Discussion



Discussion



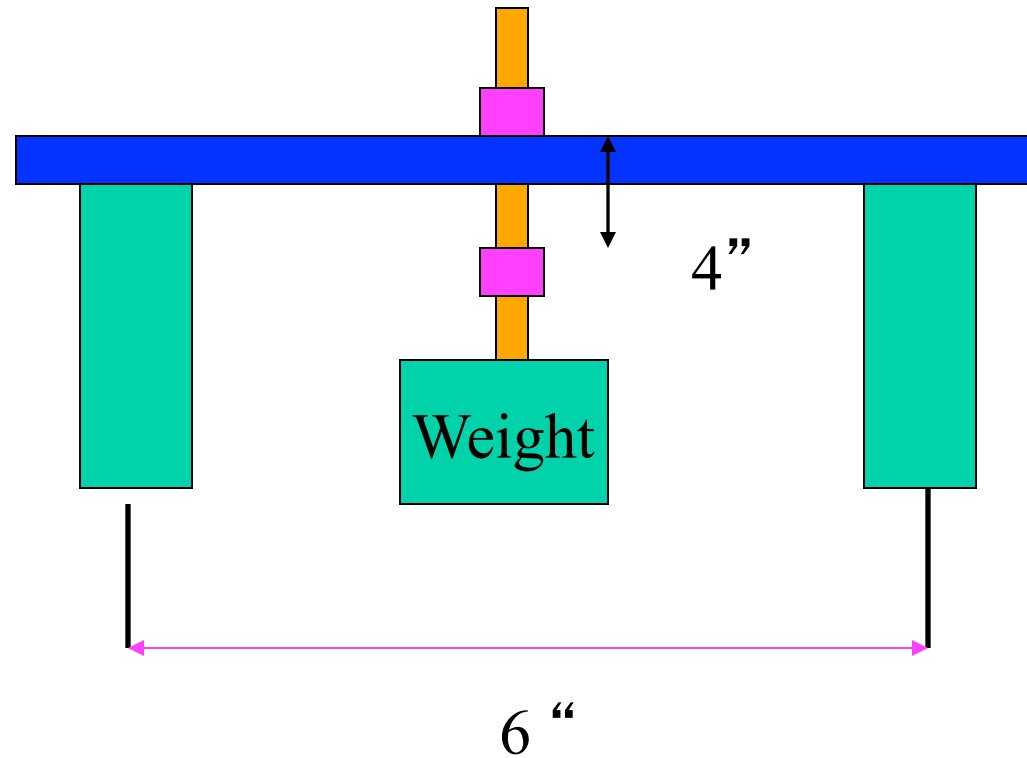
Rules

- Enter one structure per 2 person team to the competition.**
- Spend up to \$7.5 for material (receipt req'd).**
- All parts must be edible (Food Grade)**
- Must fit onto test rig**

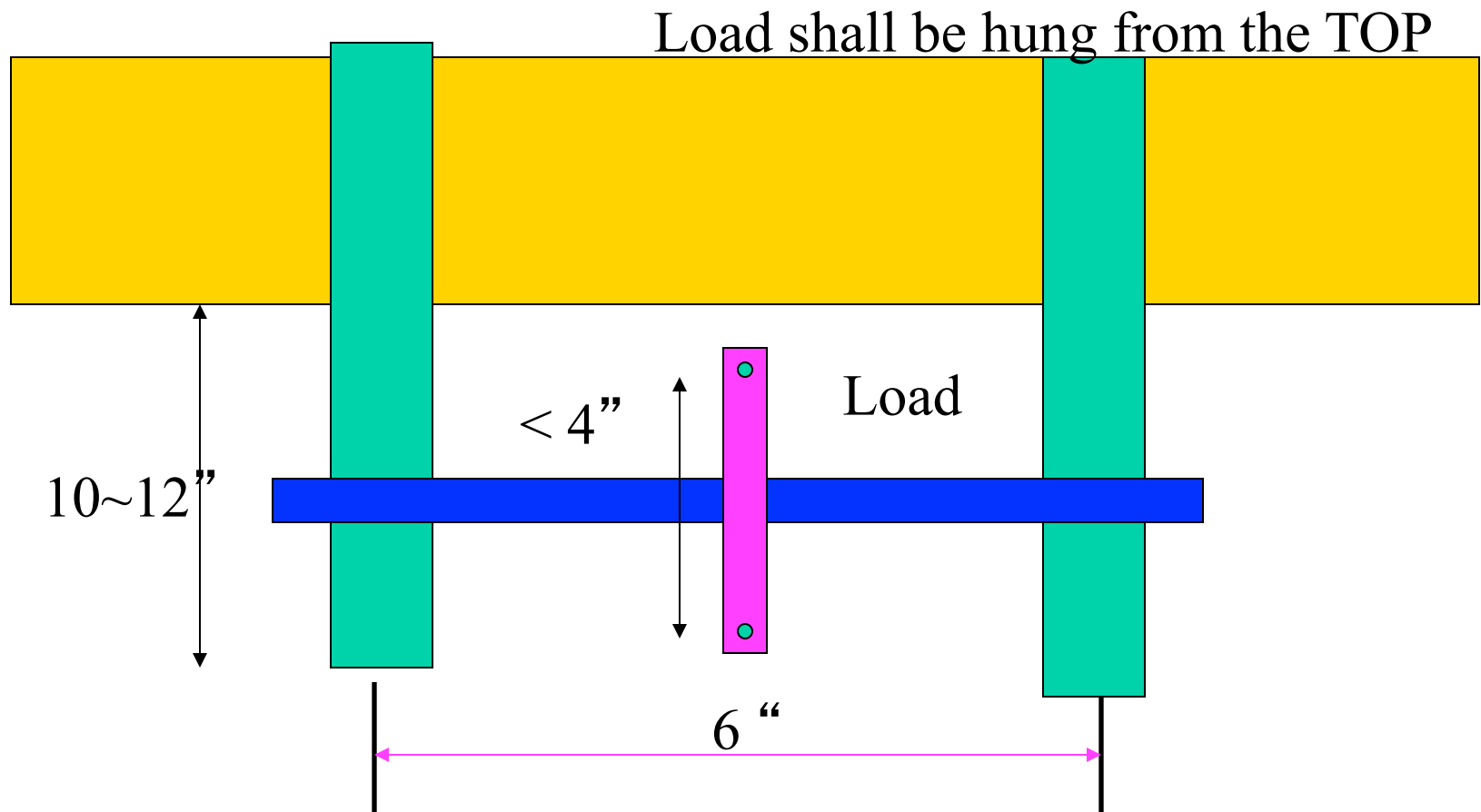
Size Requirement (Side View)

Load shall be hung from the TOP

Load



Size Requirement (Top View)



Bridge Testing Rig



Rating Sheet Team

Name: _____

Weight of Structure	
Total Weight Held	
Innovative (Advisor ?)	1 - 5
Aesthetics (beauty, does it look like a bridge- peer)	1 - 5
	(Total weight held/Weight of Structure/Averaged Value) + Aesthetics/ Average Value + Innovation/Average Values
Figure of Merit	

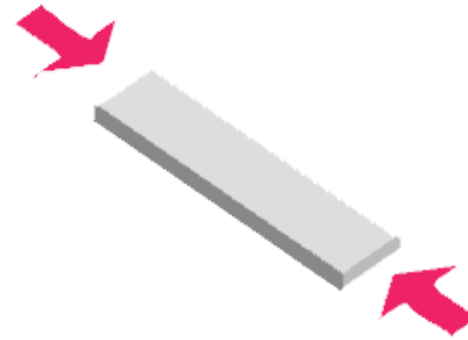
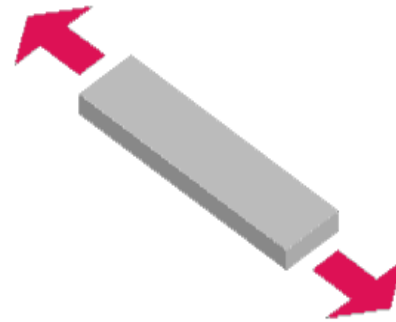
Things to Talk about

- ❑ Team Roles?
- ❑ What to build?
- ❑ How to build?
- ❑ Who brings what?
- ❑ Develop a team process!
- ❑ Remember the time constraints (~2 hours)
- ❑ Plan/Discuss a head of time.. Otherwise, you'll building a bridge with what we have in the office

Remember the rule: we may require you to demonstrate that material is edible!

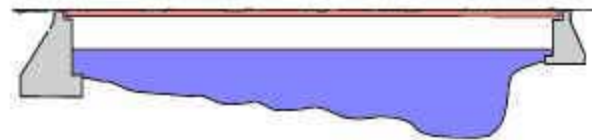
Forces in a simple Truss

- Tensile forces tend to lengthen a member
- Compressive forces tend to shorten or compress a member

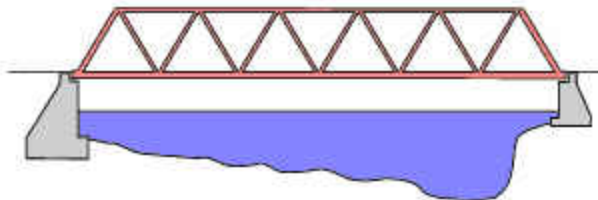


Bridge types

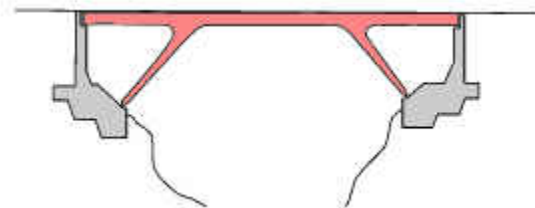
- Girder



- Truss

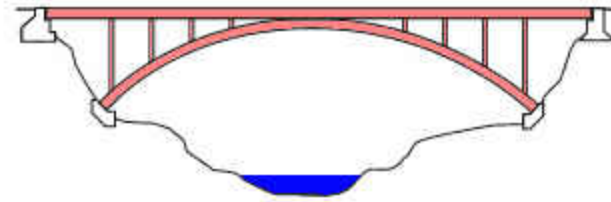


- Rigid Frame

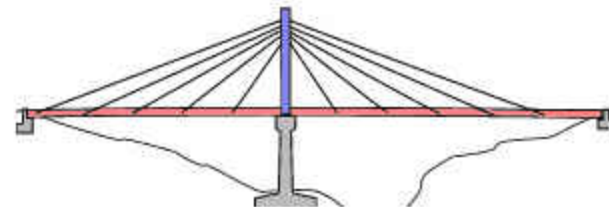


Bridge types (continued)

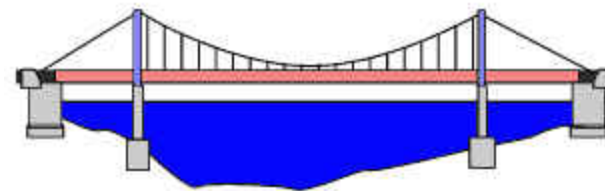
- Arch



- Cable Stayed



- Suspension



Common Forms of Failure

- Buckling or crushing for members in compression
- Pulling apart in the middle for members in tension
- Pulling apart at the joints

Materials Supplied by the Advisors

- Building Mats/Hobby Knife/Scissor
- Paper for Drawing
- Test Rig
- Advice
- Encouragement

Discussion

- ❑ Why did some hold more load than others ?
- ❑ But they looked different?
- ❑ Why did you build your bridge way you did?
- ❑ What do you think you need to know before you build a better bridge?

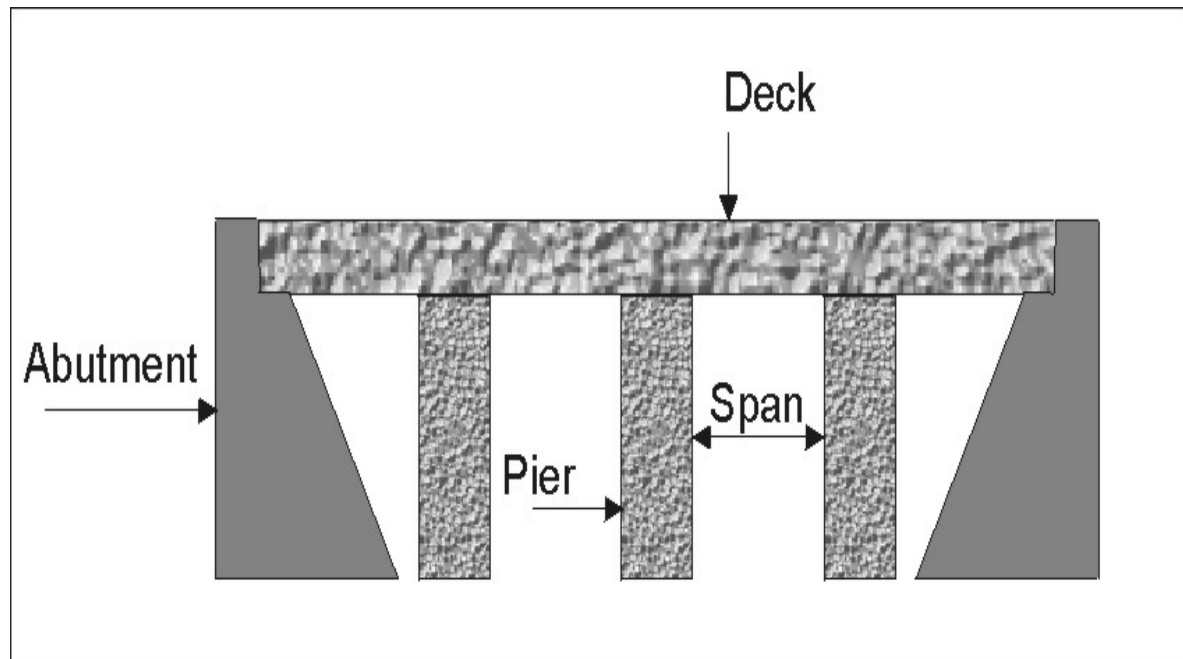
Reference

Bridge Sites

[How Bridges Work](#)

Bridge Components

- Deck
- Pier
- Span
- Abutment





Bridge Build



YF-12A

